PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

Final Report
Investigation Results For
Minnesota Academy for the Blind

Date: 6/20/2012

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PBEEEP
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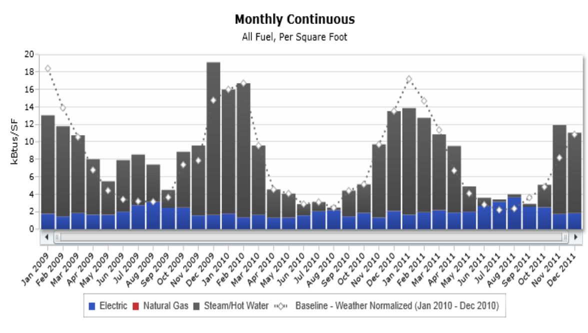
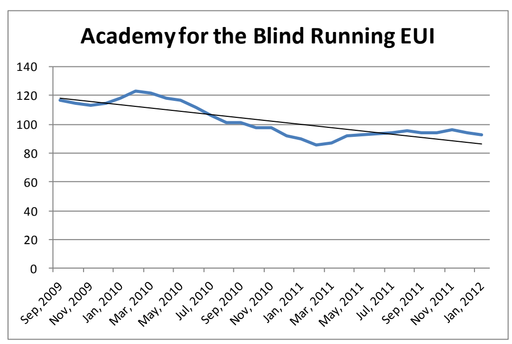
Minnesota Academy for the Blind Energy Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of Minnesota Academy for the Blind was performed by Karges, Faulconbridge, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$35,393		Total Project Cost	$65,937
Future costs including Implementation , Measurement & Verification	$30,544		Study and Administrative Cost Paid with ARRA Funds	($38,393)
Total Project Cost	$65,937		Utility Co-funding	($0)
			Total costs after co-funding	$27,544
Estimated Annual Total Savings ($)	$6,992		Estimated Annual Total Savings ($)	$6,992
Total Project Payback	9.4		Total Project Payback with co-funding	3.9
Electric Energy Savings	**5.6%**	**and**	**Steam Savings**	**4.2 %**





Minnesota Academy for the Blind Consumption Report
Total energy use increased 2% during the period of the investigation

Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	122,666	14,096,674	11,947,991	2,148,683	18%	$178,803.58	$0.01
2010	365	122,666	11,292,267	11,292,267	0	0%	$160,106.26	$0.01
2011	365	122,666	11,503,212	10,902,117	601,094	6%	$183,089.09	$0.02

STATE OF MINNESOTA B3 BENCHMARKING

Summary Tables

Minnesota Academy for the Blind	
Location	400 SE 6th Ave, Faribault, MN 55021
Facility Manager	Randy Dirks
State's Project Manager	Peter Hargreaves
Interior Square Footage	122,666
PBEEEP Provider	Karges, Faulconbridge, Inc.
Annual Energy Cost	$ 183,089 (2011) Source: B3
Utility Company	Xcel Energy (electric and gas) MCF Faribault (steam)
Site Energy Use Index (EUI)	92 kBtu/ft^2 (at start of study) 94 kBtu/ft^2 (at end of study)
Benchmark EUI (from B3)	105 kBtu/ft^2

Building Name	**State ID**	**Area (Square Feet)**	**Year Built**
Gillen Hall	E4400200666	21,127	1957
Lysen and Dorms	E4400201866	67,954	1971
Library for the Blind	E4400201666	21,201	1959

Mechanical Equipment Summary Table (of buildings included in the investigation)	
Quantity	**Equipment Description**
1	Building Automation System
110,282	Square Feet
11	Air Handlers
1	Roof Top Unit
1	Fan Coil Units
76	VAV Boxes (estimated)
3	Chillers
14	Pumps (HW and CHW)
8	Exhaust Fans
1,600	Points Available for Trending
500	Minimum Points for Investigation
50	Data Loggers Required

Implementation Information			
Estimated Annual Total Savings ($)			$6,992
Total Estimated Implementation Cost ($)			$27,544
GHG Avoided in U.S Tons (CO2e)			77
Electric Energy Savings (kWh) 5.6 % Savings 2011 Electric Usage 992,423 kWh (from B3)			55,583
Electric Demand Savings (Peak kW)			0
Steam Savings 4.2 % Savings 2011 Steam Usage 8,102 MMBtu (from B3)			338
Statistics			
Number of Measures identified			10
Number of Measures with payback < 3 years			6
Screening Start Date	1/30/2010	Screening End Date	4/7/2010
Investigation Start Date	6/20/2011	Investigation End Date	4/3/2012
Final Report	6/21/2012		7/30/2012

Minnesota Academy for the Blind Cost Information			
Phase		**To date**	**Estimated**
Screening			
Investigation [Provider]		$27,570	
Investigation [CEE]		$7,823	$1,000
Implementation			$27,544
Implementation [CEE]			$1,000
Measurement & Verification			$1,000
Total		$35,393	$30,544

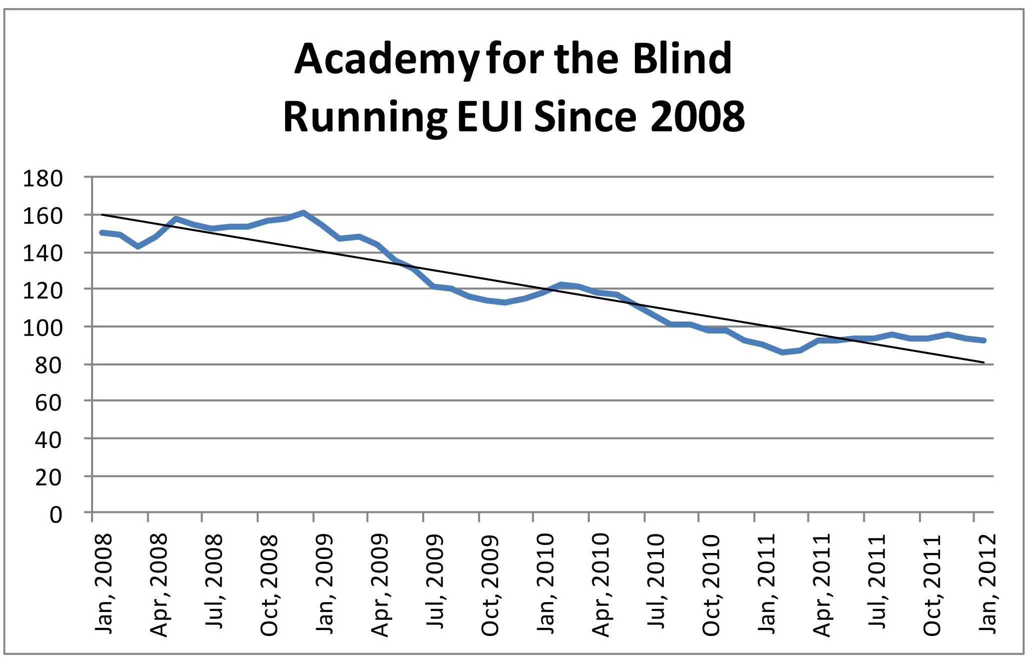
Co-funding Summary	
Study and Administrative Cost	$38,393
Utility Co-Funding - Estimated Total ($)	$0
Total Co-funding ($)	$38,393

Facility Overview

The energy investigation identified 4.6 % of total energy savings at Minnesota Academy for the Blind with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Minnesota Academy for the Blind are based on correcting equipment schedules to correspond to actual periods of building use, replacing 32 W lamps with 28 watt lamps, and addressing a number of deferred maintenance issues. The total cost of implementing all the measures is $27,544.

Implementing all of these measures can save the school approximately $6,992 a year with a combined payback period of 3.9 years before rebates based on the implementation cost only (excluding study and administrative costs). These measures will produce 5.6% electrical savings and 4.2 % steam savings. The building is currently performing at 10% below the Minnesota Benchmarking and Beyond database (B3) benchmark.

Since 2007, the energy use at the Minnesota Academy for the Blind has declined over 30% as is shown in the graph below, taken from data reported in B3.



The primary energy intensive systems at Minnesota Academy for the Blind are described here:

This facility has buildings on it which were built between 1926 and 1971. The majority of the facility is compromised of two buildings which include the dormitory rooms for the residents on campus. These buildings compromise roughly 70% of the facility. The building controls for these two buildings were recently upgraded to DDC from pneumatics. This project was designed by an engineer and commissioned. The Library is also heavily used and had an HVAC upgrade performed in 2003.

Mechanical Equipment
Overall, there are eleven air handlers, one roof top unit, three chillers, four chilled water pumps, and eight hot water pumps. Areas of the building which do not receive heat directly from the AHUs are primarily heated by finned tube radiation. The steam is brought to the facility by the power plant at MCF Faribault and is metered accordingly. The two storage buildings only contain finned tube radiation.

Controls and Trending

The two main buildings run on a single automation system (Alerton) which was installed in March of 2010. This system is capable of trending and every point can is set up for trending right now, however the amount of history that can be accumulated is not known. Currently it appears that one month of data is stored before it is overwritten. The library is controlled by stand alone pneumatics and is not part of the automation system. The remaining two buildings only contain finned tube radiation and unit heaters which are not on the new automation system and are either controlled by valves, or thermostats.

Lighting
Most of the interior lighting consists of T8 32 watt lights. These lights are mainly controlled by switches. There are occupancy sensors in some areas, such as the basement of the library.

Energy Use Index and B3 Benchmark
The site Energy Use Index (EUI) for all buildings is 94 kBtu/sq ft, which is 10% lower than their B3 Benchmark of 105 kBtu/sq ft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks.

Metering
There is a total of one electric meter, one gas meter, and one steam meter for the campus.

Findings Summary

Site: Mn Academy of the Blind

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	Library for the Blind	AHU-2 Scheduling	$100	$2,446	0.04	$0	0.04	25
8	Gillen Activities Bldg	AHU's to dorms run when spaces are not occupied	$10	$78	0.13	$0	0.13	1
1	Library for the Blind	AHU- 1 Scheduling	$100	$521	0.19	$0	0.19	7
2	Gillen Activities Bldg	Repair steam leak in lower level mechanical room	$500	$819	0.61	$0	0.61	6
6	Gillen Activities Bldg	Optimal start tuning	$960	$386	2.48	$0	2.48	6
3	Gillen Activities Bldg	Insulate piping in lower level mechanical room	$1,066	$404	2.64	$0	2.64	3
3	Library for the Blind	AHU-2 CO2 Control	$2,500	$732	3.41	$0	3.41	6
7	Gillen Activities Bldg	AHU 4 and AHU 6 have significant air leaks at floor penetration point.	$500	$45	11.15	$0	11.15	1
4	Gillen Activities Bldg	Replace 32W lamps with 28 W lamps	$16,148	$1,200	13.45	$1,604	12.12	17
4	Library for the Blind	Lighting	$5,660	$360	15.74	$566	14.16	5
		Total for Findings with Payback 3 years or less:	**$2,736**	**$4,655**	**0.59**	**$0**	**0.59**	**48**
		Total for all Findings:	**$27,544**	**$6,992**	**3.94**	**$2,170**	**3.63**	**77**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Finding Type Number	Finding Type	Relevant Findings	looked for, not found	Not relevant
a.1 (1)	Time of Day enabling is excessive	1		1
a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	1		1
a.3 (3)	Lighting is on more hours than necessary.		1	1
a.4 (4)	OTHER_Equipment Scheduling/Enabling	1		1
b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	1		1
b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	2		
b.3 (7)	OTHER_Economizer/OA Loads			2
c.1 (8)	Simultaneous Heating and Cooling is present and excessive			2
c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	1		1
c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			2
c.4 (11)	OTHER_Controls			2
d.1 (12)	Daylighting controls or occupancy sensors need optimization.			2
d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	1		1
d.3 (14)	Fan Speed Doesn't Vary Sufficiently		1	1
d.4 (15)	Pump Speed Doesn't Vary Sufficiently	1		

d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			2
d.6 (17)	Other_Controls (Setpoint Changes)	2		
e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			2
e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			2
e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			2
e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			2
e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			2
e.6 (22)	Other_Controls (Reset Schedules)			2
f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	1		1
f.2 (24)	Pump Discharge Throttled			2
f.3 (25)	Over-Pumping	1		1
f.4 (26)	Equipment is oversized for load.			2
f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			1
g.1 (28)	VFD Retrofit - Fans			2
g.2 (29)	VFD Retrofit - Pumps	2		
g.3 (30)	VFD Retrofit - Motors (process)			2
g.4 (31)	OTHER_VFD			2
h.1 (32)	Retrofit - Motors	1		1
h.2 (33)	Retrofit - Chillers			2

h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			1
h.4 (35)	Retrofit - Boilers			2
h.5 (36)	Retrofit - Packaged Gas fired heating			2
h.6 (37)	Retrofit - Heat Pumps			2
h.7 (38)	Retrofit - Equipment (custom)			2
h.8 (39)	Retrofit - Pumping distribution method			2
h.9 (40)	Retrofit - Energy/Heat Recovery	1	1	
h.10 (41)	Retrofit - System (custom)			2
h.11 (42)	Retrofit - Efficient Lighting	2		
h.12 (43)	Retrofit - Building Envelope			2
h.13 (44)	Retrofit - Alternative Energy			2
h.14 (45)	OTHER_Retrofit			2
i.1 (46)	Differed Maintenance from Recommended/Standard	1		1
i.2 (47)	Impurity/Contamination			2
i.3 ( )	Leaky/Stuck Damper	1	1	
i.4 ( )	Leaky/Stuck Valve		2	
i.5 (48)	OTHER_Maintenance	2		
j.1 (49)	OTHER			1

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**	
		• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**	
		• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**	
		• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**	
		• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**	
		• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**	
		• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**	
		• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**	
		• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**	
		• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**	
		• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**	
		• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**	
		• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**	
		• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**	
		• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**	
		• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**	
		• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**	
		• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**	
		• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**	
		• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**	
		• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**	
		• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**	
		• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**	
		• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**	
		• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**	
		• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**	
		• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**	
		• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**	
		• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**	
		• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**	
		• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**	
		• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**	
		• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**	
		• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**	
		• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**	
		• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**	
		• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**	
		• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**	
		• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**	
		• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**	
		• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**	
		• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**	
		• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**	
		• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**	
		• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**	
		• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**	
		• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**	
		• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**	
		• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**	
		• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**	
		• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**	
		• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**	
		• Please contact PBEEEP Project Engineer for approval

Findings Summary

Building: Gillen Activities Bldg
Site: Mn Academy of the Blind

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
8	AHU's to dorms run when spaces are not occupied	$10	$78	0.13	$0	0.13	1
2	Repair steam leak in lower level mechanical room	$500	$819	0.61	$0	0.61	6
6	Optimal start tuning	$960	$386	2.48	$0	2.48	6
3	Insulate piping in lower level mechanical room	$1,066	$404	2.64	$0	2.64	3
7	AHU 4 and AHU 6 have significant air leaks at floor penetration point.	$500	$45	11.15	$0	11.15	1
4	Replace 32W lamps with 28 W lamps	$16,148	$1,200	13.45	$1,604	12.12	17
	Total for Findings with Payback 3 years or less:	**$2,536**	**$1,688**	**1.50**	**$0**	**1.50**	**16**
	Total for all Findings:	**$19,184**	**$2,933**	**6.54**	**$1,604**	**5.99**	**35**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Gillen Activities Bldg

FWB Number:	10951	Eco Number:	2
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	Repair steam leak in lower level mechanical room	Date Identified:	8/31/2011
Description of Finding:	Repair Steam Leak in Lower Level Mechanical Room. Steam is leaking in a lower level mechanical room through a flange.		
Equipment or System(s):	Other	Finding Category:	Maintenance Related Problems
Finding Type:	Deferred Maintenance from Recommended/Standard		

Implementer:	Owner	Benefits:	Eliminate wasted steam usage
Baseline Documentation Method:	Witnessed steam leak at flange in basement. Estimated steam plume length with a piece of paper.		
Measure:	Repair Steam Leak		
Recommendation for Implementation:	Repair Steam Leak. We believe this to have been corrected immediately after we showed the owner the issue.		
Evidence of Implementation Method:	Inspect the leaking area. Obtain a work order or paid invoice for the work.		

Annual District Energy-Steam Savings (kBtu):	74,460	Contractor Cost ($):	$500
Est Annual District Energy-Steam Savings ($):	$819	PBEEEP Provider Cost for Implementation Assistance ($):	$0
		Total Estimated Implementation Cost ($):	$500

Estimated Annual Total Savings ($):	$819	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.61	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.61	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	6	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	11.7%	Percent of Implementation Costs:	1.8%

Findings Details

Building: Gillen Activities Bldg

FWB Number:	10951	Eco Number:	3
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	Insulate piping in lower level mechanical room	Date Identified:	8/31/2011
Description of Finding:	Insulate Piping in Lower Level mechanical Room. Insulation is missing from pipe and a heat exchanger in the lower level mechanical room. Room is excessively hot during summer months.		
Equipment or System(s):	Other	Finding Category:	Maintenance Related Problems
Finding Type:	Deferred Maintenance from Recommended/Standard		

Implementer:	Owner	Benefits:	Reduce unecessary heat loss/gain at piping
Baseline Documentation Method:	Recorded missing insulation at piping in the lower level mechanical room. Recorded pipe material and usage.		
Measure:	Insulate Piping		
Recommendation for Implementation:	Insulate the piping and heat exchanger where insulation is currently missing.		
Evidence of Implementation Method:	Verify insulation has been installed. Provide paid invoices for work.		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	43 $3	Annual District Energy-Steam Savings (kBtu): Est Annual District Energy-Steam Savings ($):	36,512 $402
Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$1,066 $0 $1,066		

Estimated Annual Total Savings ($): Initial Simple Payback (years): Simple Payback w/ Utility Co-Funding (years): GHG Avoided in U.S. Tons (C02e):	$404 2.64 2.64 3	Utility Co-Funding for kWh ($): Utility Co-Funding for kW ($): Utility Co-Funding for therms ($): Utility Co-Funding - Estimated Total ($):	$0 $0 $0 $0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	5.8%	Percent of Implementation Costs:	3.9%

Findings Details

Building: Gillen Activities Bldg

FWB Number:	10951	Eco Number:	4
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	Replace 32W lamps with 28 W lamps	Date Identified:	8/31/2011
Description of Finding:	Re-Lamping of 32 W lamps with 28 W Lamps. We did not evaluate the rooms for reducing the number of fixtures. We looked at utilizing what was in place at a lower Wattage. Typically rooms in this type of building are over lamped. Reducing the power at the fixtures from 32W to 28W per lamp is not expected to affect lighting quality. Hours based on occupied times in the building, excluding summer.		
Equipment or System(s):	Interior Lighting	Finding Category:	Retrofits
Finding Type:	Retrofit - Efficient Lighting		

Implementer:	Owner	Benefits:	Reduce power requirements at lamps with no affect on lighting output
Baseline Documentation Method:	Review installation of lamps. Provide reciepts for lamps that have been purchased and installed.		
Measure:	Re-lamp 32W T8 fixtures with 28W T8 lamps		
Recommendation for Implementation:	Replace T8 32 Watt lights with T8 28 Watt lights. This is a lamp for lamp replacement. Once all lights are replaced with 28 Watt lights, no more T8 32 Watt lights should be purchased.		
Evidence of Implementation Method:	Verify new lamps are installed. Provide reciepts for lamps purchased and work completed. Pictures of new lamps will be taken.		

Annual Electric Savings (kWh):	20,342	Contractor Cost ($):	$16,148
Estimated Annual kWh Savings ($):	$1,200	PBEEEP Provider Cost for Implementation Assistance ($):	$0
		Total Estimated Implementation Cost ($):	$16,148

Estimated Annual Total Savings ($):	$1,200	Utility Co-Funding for kWh ($):	$1,604
Initial Simple Payback (years):	13.45	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	12.12	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	17	Utility Co-Funding - Estimated Total ($):	$1,604

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	17.2%	Percent of Implementation Costs:	58.6%

Findings Details

Building: Gillen Activities Bldg

FWB Number:	10951	Eco Number:	6
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	Optimal start tuning	Date Identified:	1/17/2012
Description of Finding:	Optimal start fine tuning. We found that the building space temperatures in general remain relatively consistent when the units are off. Several of the units have the fans come on for periods of time when the space temperatures do not require heating. The current situation has the fans running longer than necessary to maintain night set back temperatures.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Control Contractor	Benefits:	Reduce fan run time.
Baseline Documentation Method:	Trended space set points versus fan run times. Saw fans for some units coming on at 2 to 3 am in the morning for no apparent reason. The OA dampers are always closed so this is related strictly to fan run time.		
Measure:	Fine tune the optimal start sequences or eliminat them entirely and have the units on cycle on when space temperatures drop below set back temperatures. The units are scheduled early enough that a morning warm up cycle or optimal start is not necessary.		
Recommendation for Implementation:	Controls contractor to fine tune optimal start or delete it for AHU 4, 8 and 9. These were the only units that seemed affected by the optimal start being out of tune. The unit should initiate no more then one hour before the space is occupied. If the space temperature is at setpoint, the unit does not need to start until the space is occupied.		
Evidence of Implementation Method:	The following points will be trended for AHU4, 8 and 9: Oat, DAT, MAT, RAT, Fan status, Heat valve, and OA dampers. They will assure the unit does not start until one hour before occupancy of the building. During the morning warm up the fan will engage and heat valve modulate to assure the space setpoint is being met. The OA dampers will remain closed.		

Annual Electric Savings (kWh):	6,549	Contractor Cost ($):	$960
Estimated Annual kWh Savings ($):	$386	PBEEEP Provider Cost for Implementation Assistance ($):	$0
		Total Estimated Implementation Cost ($):	$960

Estimated Annual Total Savings ($):	$386	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	2.48	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	2.48	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	6	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	5.5%	Percent of Implementation Costs:	3.5%

Findings Details

Building: Gillen Activities Bldg

FWB Number:	10951	Eco Number:	7
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	AHU 4 and AHU 6 have significant air leaks at floor penetration point.	Date Identified:	8/31/2011
Description of Finding:	AHU-4 and AHU-6 have significant air leaks into the mechanical room at the location where the supply duct penetrates the floor (underfloor duct).		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Maintenance Related Problems
Finding Type:	Other Maintenance		

Implementer:	Owner/Contractor	Benefits:	Reduced fan power. System is VAV and runs harder to make cfm at VAV boxes. Also wasted cooling and heating in mechanical room.
Baseline Documentation Method:	Review access door correction for air leakage		
Measure:	Repair duct leakage at access panels in mechanical room for AHU-4 and AHU-6		
Recommendation for Implementation:	Hire a tinner to correct access door leaks or make this correction with internal staff.		
Evidence of Implementation Method:	Visually inpspect doors for leakage. Obtain paid invoice from contractor or work order from facilities as proof of correction.		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	760 $45	Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$500 $0 $500

Estimated Annual Total Savings ($):	$45	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	11.15	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	11.15	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.6%	Percent of Implementation Costs:	1.8%

Findings Details

Building: Gillen Activities Bldg

FWB Number:	10951	Eco Number:	8
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	AHU's to dorms run when spaces are not occupied	Date Identified:	2/12/2012
Description of Finding:	AHU-1 through AHU-3 run during the day hours to provide ventilation to dorms that are empty. The owner said they have to run them to keep the rooms from getting stale. We propose to run the units in occupied mode in the middle of the night for this ventilation and cycle them as necessary in unoccupied mode during the day. The spaces are unoccupied during the summer months.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Owner	Benefits:	Cheaper power at night, more likely to see economizing capable during the night. Reduced cooling load on the equipment with no loss in the ventilation ability of the units to keep the space somewhat fresh.
Baseline Documentation Method:	Review that summer changes to the schedules have been made. Review on a regular basis to ensure that changes to schedules are maintained.		
Measure:	Schedule Occupied from 2 am until 5 am in the mornings during the week to provide some ventilation to the dorm areas of the school.		
Recommendation for Implementation:	During the summer months from approximately June 10th to September 6th, AHU-1, AHU-2, and AHU-3 will operate at a schedule from 1 AM to 5 AM Monday through Friday versus the current schedule. These units will run during this time to air the spaces out and prevent stale air within them.		
Evidence of Implementation Method:	The following points will be trended for AHU-1, AHU-2, and AHU-3: OA damper, RA CO2, DAT, MAT, RAT, heat valve, space temp, fan speed, and fan status. These points will be trended for a two week period during the summer to assure the unit is followng the new schedule and not operational other times of the day.		

Annual Electric Savings (kWh):	1,328	Contractor Cost ($):	$10
Estimated Annual kWh Savings ($):	$78	PBEEEP Provider Cost for Implementation Assistance ($):	$0
		Total Estimated Implementation Cost ($):	$10

Estimated Annual Total Savings ($):	$78	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.13	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.13	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.1%	Percent of Implementation Costs:	0.0%

Findings Summary

PBEEEP State Government

Building: Library for the Blind
Site: Mn Academy of the Blind

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	AHU-2 Scheduling	$100	$2,446	0.04	$0	0.04	25
1	AHU- 1 Scheduling	$100	$521	0.19	$0	0.19	7
3	AHU-2 CO2 Control	$2,500	$732	3.41	$0	3.41	6
4	Lighting	$5,660	$360	15.74	$566	14.16	5
	Total for Findings with Payback 3 years or less:	**$200**	**$2,967**	**0.07**	**$0**	**0.07**	**31**
	Total for all Findings:	**$8,360**	**$4,059**	**2.06**	**$566**	**1.92**	**42**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Library for the Blind

FWB Number:	10952	Eco Number:	1
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	AHU- 1 Scheduling	Date Identified:	11/1/2011
Description of Finding:	The air handling unit runs 24 hours per day. Mixed air temperatures indicate the OA damper is not closed during this time. The unit should be able to run on a schedule for occupancy but there is no mechanism for this to happen as currently installed. This measure should be incorporated into the equipment once the new automation system is installed and due to that the implementation cost should be $0, but to give a payback for this measure $100 was selected for implementation cost.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	MSAB	Benefits:	Reduced run time and conditioning of ventilation air.
Baseline Documentation Method:	Trends indicate the fans are operational 24 hours per day and the OA dampers are open from looking at the Mixed air temperatures		
Measure:	Provide either time of day enabling or extend the BAS to the Library.		
Recommendation for Implementation:	When any building automation projects are on the table at the Academy of the Blind or the Deaf, earmark dollars to extend the building automation system to the Library. Once the automation system is up and running have AHU-1 scheduled on from 7 AM to 5 PM 7 days a week. When the unit is off the OA dampers will remain closed and the fan off. If the space temperature falls below space temperature setpoint, the fan will engage and the heat valve will modulate to maintain the space temperature. During unoccupied runtime, the OA dampers will remain closed. Once the unoccupied space temperature is satisfied, the unit will disengage.		
Evidence of Implementation Method:	Trend all relevant points for AHU-1, OAT, MAT, RAT, DAT, Heat valve, cooling valve, fan status, fan speed, and OA dampers. Verify the unit follows the proper sequences and schedule.		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	6,606 $389	Annual District Energy-Steam Savings (kBtu): Est Annual District Energy-Steam Savings ($):	11,972 $132
Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$100 $0 $100		

Estimated Annual Total Savings ($):	$521	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.19	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.19	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	7	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	7.4%	Percent of Implementation Costs:	0.4%

Findings Details

Building: Library for the Blind

FWB Number:	10952	Eco Number:	2
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	AHU-2 Scheduling	Date Identified:	11/1/2011
Description of Finding:	The air handling unit runs 24 hours per day. Mixed air temperatures indicate the OA damper is not closed during this time. The unit should be able to run on a schedule for occupancy but there is no mechanism for this to happen as currently installed. This measure should be incorporated into the equipment once the new automation system is installed and due to that the implementation cost should be $0, but to give a payback for this measure $100 was selected for implementation cost.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	MSAB	Benefits:	Reduced run time and conditioning of ventilation air.
Baseline Documentation Method:	Trends indicate the fans are operational 24 hours per day and the OA dampers are open from looking at the Mixed air temperatures		
Measure:	Provide either time of day enabling or extend the BAS to the Library.		
Recommendation for Implementation:	When any building automation projects are on the table at the Academy of the Blind or the Deaf, earmark dollars to extend the building automation system to the Library. Once the automation system is up and running have AHU-1 scheduled on from 7 AM to 5 PM 7 days a week. When the unit is off the OA dampers will remain closed and the fan off. If the space temperature falls below space temperature setpoint, the fan will engage and the heat valve will modulate to maintain the space temperature. During unoccupied runtime, the OA dampers will remain closed. Once the unoccupied space temperature is satisfied, the unit will disengage.		
Evidence of Implementation Method:	Trend all relevant points for AHU-1, OAT, MAT, RAT, DAT, Heat valve, cooling valve, fan status, fan speed, and OA dampers. Verify the unit follows the proper sequences and schedule.		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	13,324 $785	Annual District Energy-Steam Savings (kBtu): Est Annual District Energy-Steam Savings ($):	151,032 $1,661
Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$100 $0 $100		

Estimated Annual Total Savings ($):	$2,446	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.04	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.04	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	25	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	35.0%	Percent of Implementation Costs:	0.4%

Findings Details

Building: Library for the Blind

FWB Number:	10952	Eco Number:	3
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	AHU-2 CO2 Control	Date Identified:	11/1/2011
Description of Finding:	The unit runs in occupied mode at full ventilation rates. Install CO2 control for AHU-2 (Main Level Unit). The entire Summer, the Library is at minimal occupancy since the children are not present. The occupancy load in the winter is seldom at full capacity. Allow the unit to run at a minimum OA rate and increase the existing design rate when fully occupied.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Retrofits
Finding Type:	Other Retrofit		

Implementer:	Controls Contractor	Benefits:	Reduced ventilation load when the building is not operating under full occupancy.
Baseline Documentation Method:	Functionally test the unit operation after installation. Verify CO2 calibration. Provide training on issues with CO2 controls and calibration requirements.		
Measure:	Install CO2 sensor in return air ductwork. Balance the OA to the new minimum and let the damper modulate between the min and max OA cfm to maintain CO2 levels at 1100 ppm or 700 ppm above ambient (either method is acceptable).		
Recommendation for Implementation:	In past projects, the cost to replace CO2 sensors came in at $500 per. New installation estimated to be $1500. Balancing at $500 and engineering assistance for ASHRAE calcs at $500. The unit would have the minimum OA balanced as per ASHRAE requirements. This would be the minimum OA damper position. When the CO2 level is below 1000 ppm (adj) the OA damper will close beyond the minimum position to assure it is meeting the proper MAT setpoint and RA CO2 setpoint. When the CO2 levels climb the OA damper will modulate open. Once the OA damper is at the balanced minimum position and the CO2 levels go above 1000 ppm (adj), the OA damper will not modulate further due to meeting ASHRAE OA requirements for the space.		
Evidence of Implementation Method:	Trend all relevant points for AHU-2, OAT, MAT, RAT, DAT, Heat valve, cooling valve, fan status, fan speed, OA dampers, and RA CO2. Verify the unit follows the proper sequences and schedule.		

Annual Electric Savings (kWh):	525	Annual District Energy-Steam Savings (kBtu):	63,750
Estimated Annual kWh Savings ($):	$31	Est Annual District Energy-Steam Savings ($):	$701
Contractor Cost ($):	$2,000		
PBEEEP Provider Cost for Implementation Assistance ($):	$500		
Total Estimated Implementation Cost ($):	$2,500		

Estimated Annual Total Savings ($):	$732	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.41	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.41	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	6	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	10.5%	Percent of Implementation Costs:	9.1%

Findings Details

Building: Library for the Blind

FWB Number:	10952	Eco Number:	4
Site:	Mn Academy of the Blind	Date/Time Created:	6/21/2012

Investigation Finding:	Lighting	Date Identified:	11/1/2011
Description of Finding:	The complex currently contains all T8 32 Watt lighting fixtures. There are now more energy efficient fixtures which can be used.		
Equipment or System(s):	Interior Lighting	Finding Category:	Retrofits
Finding Type:	Retrofit - Efficient Lighting		

Implementer:	MSAB	Benefits:	Reduced power without significant loss in light output.
Baseline Documentation Method:	Lighting count of existing lamps for T8 fixtures. Used library run time for hours calculations.		
Measure:	Replace 32W lamps with 28W lamps.		
Recommendation for Implementation:	Re-lamp the 32W T8 fixtures with 28W lamps. Complete Xcel Lighting rebate form and submit for rebates. All new lights purchased shall be T8 28 Watt lights versus T8 32 Watt lights. This will be done to assure no new lights will be replaced with old lights.		
Evidence of Implementation Method:	Verify lamps have been replaced. Provide receipts for lamps, completed work orders or paid invoices as evidence that work has been completed. Pictures of the new lamps shall be taken.		

Annual Electric Savings (kWh):	6,106	Contractor Cost ($):	$5,660
Estimated Annual kWh Savings ($):	$360	PBEEEP Provider Cost for Implementation Assistance ($):	$0
		Total Estimated Implementation Cost ($):	$5,660

Estimated Annual Total Savings ($):	$360	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	15.74	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	14.16	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$566

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	5.1%	Percent of Implementation Costs:	20.5%

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10951 - MN Academies for Blind-Lysen and Gillen

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	No		Not Relevant	Schedules are reasonable. AHU-9 appears to run 24 hours; does not appear to follow the schedules.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	No		Not Relevant	Equipment does not appear to run unnecessarily.
	a.3 (3)	Lighting is on more hours than necessary.	No		Not Relevant	Lighting is not excessive. During field investigation, notes were made that lighting was not on in areas that were not occupied or had been occupied recently.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	Yes	AHU-9		AHU-9 has a schedule but appears from trend data to be running 24 hours per day. This was seen in the summer and swing season. Will verify similar for winter.
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	No		Not Relevant	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	Yes	AHU's		The CO2 readings in the building are always very low. We know the sensors are reading about 200 ppm low on average. Even with the adjustment up, the 10% values for OA appear to be high. We measured the OA concentration at approximately 500 ppm which would allow the school to set the interior concentration to 1100 ppm and maintain required ventilation.
	b.3 (7)	OTHER_Economizer/OA Loads	No		Not Relevant	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	No		Not Relevant	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	Yes	CO2		CO2 sensors all read low. Should be recalibrated. Not an energy savings when reading low but would allow ventilation to be tracked more accurately.
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	No		Not Relevant	Did not find dampers or valves to be modulating out of control. DAT's, and space temperatures were consistent through trending.
	c.4 (11)	OTHER_Controls	No		Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	No			Lighting controls appear to be functioning correctly where installed.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Yes			Will investigate optimal start. Dampers were closed but optimal start turned on units at odd times of the night. There does not appear to be a good reason for the fans to be energizing. Checked all factors and could not identify anything that would have triggered optimal start. Will estimate savings to switch to fixed morning warm up instead.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	No		Not Relevant	Fan speed vary. Some fans vary more than others but this could be related to the differential between max and min VAV position or diversity in the system. SP set points are reasonable.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently				
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	No			I don't know how to answer this. Technically, the minimum could be zero with occupancy control. I don't know that they boxes are out of line. We don't see evidence of over cooling spaces.
	d.6 (17)	Other_Controls (Setpoint Changes)	Yes	Heating Water Pumps		The heating water pumps are enabled at 68 degrees but the heating system is not enabled until the OAT reaches 60 degrees. Pumps run in bypass for all hours between 60 and 68 degrees. Adjust pump enable to match the heating system enable. Save on pump run time for large numbers of hours.
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	They are using hot water reset and it functions as intended.

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Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	No			This is a risky strategy for this climate. There are many days that would have reset temperatures that might not match up with the mixed air conditions. Humidity control is important. We did not see temperatures fluctuating wildly which indicates the valves are operating correctly and the piping that we observed was all insulated. The heat gain through an insulated pipe that is 45 degrees versus 55 degrees is expected to be very minimal for stand by losses.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	Reset temperatures have been observed through trending.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal	No			Duct Static pressure settings are not unreasonable.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	
	e.6 (22)	Other_Controls (Reset Schedules)	No		Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	Yes	T-8 32 W Lamps		Lighting counts were conducted and totaled. Estimated run hours were included in calcs to show benefit to re-lamp with 28W T8's versus 32W. Industry information indicates most rooms are over designed. Installing 28W lamps is expected to have a minimal effect on the overall lighting.
	f.2 (24)	Pump Discharge Throttled	No			
	f.3 (25)	Over-Pumping	Maybe			Still looking at some of the pumping
	f.4 (26)	Equipment is oversized for load.	No			
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction				
g. Variable Frequency Drives (VFD):	g.1 (28)	VFD Retrofit - Fans	No			Fans that are variable speed have vfd's installed
	g.2 (29)	VFD Retrofit - Pumps	Maybe			Looking at Chilled water system.
	g.3 (30)	VFD Retrofit - Motors (process)	No		Not Relevant	
	g.4 (31)	OTHER_VFD	No		Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors	No		Not cost-effective to investigate	Change to premium efficiency as motors fail. Payback becomes signifcanly less under this scenario.
	h.2 (33)	Retrofit - Chillers	No		Not cost-effective to investigate	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)				
	h.4 (35)	Retrofit - Boilers	No		Not Relevant	No Boilers
	h.5 (36)	Retrofit - Packaged Gas fired heating	No		Not Relevant	No gas fired heating HVAC
	h.6 (37)	Retrofit - Heat Pumps	No		Not Relevant	Not a heat pump system
	h.7 (38)	Retrofit - Equipment (custom)	No			
	h.8 (39)	Retrofit - Pumping distribution method	No			
	h.9 (40)	Retrofit - Energy/Heat Recovery	Yes	Pool Unit		We will investigate the pool unit during the heating season
	h.10 (41)	Retrofit - System (custom)	No			
	h.11 (42)	Retrofit - Efficient Lighting	Yes	T8's		Relamping

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Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
	h.12 (43)	Retrofit - Building Envelope	No			No evidence of extreme envelope integrity
	h.13 (44)	Retrofit - Alternative Energy	No			
	h.14 (45)	OTHER_Retrofit	No			
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	Yes			Coils are impossible to clean. This style of unit makes coil access inaccessible. Yes, the coils should be cleaned annally but in reality it would be very difficult.
	i.2 (47)	Impurity/Contamination	No			No evidence.
	i.3 ( )	Leaky/Stuck Damper	Maybe			There is some evidence of OA dampers that leak. This will be more evident as the OAT and RAT differential becomes greater in late November or December.
	i.4 ( )	Leaky/Stuck Valve	U/K			Did not see any evidence for cooling. Heating has not been investigated at this time.
	i.5 (48)	OTHER_Maintenance	Pipe insulation			There is quite a bit of uninsulated piping in the lower level mechanical room. Fortunately the pipe is mainly steel which conducts heat at a much lower rate than copper. Regardless, there are savings that are associated with pipe insulation that have been calculated and included in the 50% submission.
j. OTHER	j.1 (49)	OTHER				

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10952 - MN Academies for Blind-Library

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	Yes			Air handling units run 24/7 in occupied mode.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	Yes			See above
	a.3 (3)	Lighting is on more hours than necessary.	No		Investigation looked for, but did not find this issue.	Lighting was logged and lights dimmed at night with occ sensors.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	No			Pumps run 24/7 with the air handling units. Do not want to cycle pumps on and off.
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	Yes			Economizer was investigated with modest savings for one of the units. There are no return air dampers that we can see. Would have to add dampers and control for them in the return air ducts. Ran number initially and the cost savings were low due to the total airflow of the unit and the relatively low internal loads.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	Yes			AHU-2 over ventilates based on the full time occupancy. AHU-1 over ventilates but not by a significant amount. It is questionable how much the lower level has to be ventilated since it has no full time occupants.
	b.3 (7)	OTHER_Economizer/OA Loads	No		Not Relevant	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	No			Did not see evidence of this
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	No			Sensors that were checked were close to measured.
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	No			Hard to determine with no BAS.
	c.4 (11)	OTHER_Controls	No			Limited controls in this building
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	No			Lights are on occ sensors and there is limited daylighting opportunity.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	No			This might be a possibilty but currently the units run 24/7. The concrete construction may make recovery tough if reset is too low. Difficult to suggest reset temperature to run calculations based on building interiors.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	The fan speed doesn't vary but it is likely that it wouldn't vary much based on the location of the one VAV box relative to the fan.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	Yes			There is no VFD on the heating water pumps.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	No			Could not determine what the minimums were and what a new minimum might be.
	d.6 (17)	Other_Controls (Setpoint Changes)	Yes		Not cost-effective to investigate	Hard to determine the savings. Not worth the time to run calculations. Set points should be at the State guidelines of 75 DB summer and 68 DB winter. Calculations for this measure are not all that significant because the cost to implement is essentially zero.
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	We do not suggest this measure for most buildings in Minnesota. Loss of dehumidification is possible on cooler humid days. Do not believe it is worth the savings to implement this measure.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	Trend data shows SAT temperatures vary
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal	No		Not Relevant	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	No Cooling Tower
	e.6 (22)	Other_Controls (Reset Schedules)	No			
	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	No		Not Relevant	
	f.2 (24)	Pump Discharge Throttled	No			

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Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
f. Equipment Efficiency Improvements / Load Reduction:	f.3 (25)	Over-Pumping	No		Not cost-effective to investigate	Small horsepower pumps.
	f.4 (26)	Equipment is oversized for load.	Yes		Not cost-effective to investigate	AHU-1 is likely oversized for the lower level of the library. The unit is in good shape and there is no reason to replace it. The savings will not justify the expense of replacement.
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction	No		Not Relevant	
g. Variable Frequency Drives (VFD):	g.1 (28)	VFD Retrofit - Fans	No		Not Relevant	
	g.2 (29)	VFD Retrofit - Pumps	Yes			Heating Water pumps
	g.3 (30)	VFD Retrofit - Motors (process)	No		Not Relevant	
	g.4 (31)	OTHER_VFD	No		Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors	Yes			Not as part of this program but should replace motors with premium efficiency as they fail. The payback becomes reasonable under this scenario.
	h.2 (33)	Retrofit - Chillers	No		Not Relevant	Equipment is not all that old and would not be replaced with a central chiller plant.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	No		Not Relevant	
	h.4 (35)	Retrofit - Boilers	No		Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating	No		Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps	No		Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)	No		Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method	No		Not cost-effective to investigate	
	h.9 (40)	Retrofit - Energy/Heat Recovery	No		Investigation looked for, but did not find this issue.	There is not enough required exhaust in this building to make it worth while.
	h.10 (41)	Retrofit - System (custom)	No		Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting	Yes			Replace T8 32 W lamps with T8 28 W lamps
	h.12 (43)	Retrofit - Building Envelope	No			Envelope is in pretty good shape.
	h.13 (44)	Retrofit - Alternative Energy	NO		Investigation looked for, but did not find this issue.	Not for this study, but a building this small probably could generate domestic hot water from a small vacuum tube assembly. It would be a great project with a grant but would not be expected to pay itself back less than decades due to low usage.
	h.14 (45)	OTHER_Retrofit	No		Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	No		Not Relevant	The dry cooler on the roof was observed to be very dirty and clogged with cottonwood. The coils should be cleaned. They probably are and we just caught it before they maintenance could take care of it. Have not been back on the roof since late summer.
	i.2 (47)	Impurity/Contamination	No		Not Relevant	
	i.3 ( )	Leaky/Stuck Damper	No		Investigation looked for, but did not find this issue.	Did not see the dampers sticking. They are open all of the time when the unit runs and that is currently 24/7.
	i.4 ( )	Leaky/Stuck Valve	No		Investigation looked for, but did not find this issue.	

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10952 - MN Academies for Blind-Library

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Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
	i.5 (48)	OTHER_Maintenance	Yes		Investigation looked for, but did not find this issue.	The dry cooler on the roof was observed to be very dirty and clogged with cottonwood. The coils should be cleaned. They probably are and we just caught it before they maintenance could take care of it. Have not been back on the roof since late summer.
j. OTHER	j.1 (49)	OTHER	NO			

Deleted Findings Report: Minnesota Academy for the Blind

FWB Number:	10951	Eco #:	1	Building:	Gillen Activities Bldg
Investigation Finding:	Pumps should be enabled at the same temperature that heating is enabled		Equipment or System(s):	Pump, other	
Measure:	Set heating pump enable to match building heating enable set point. Contractor cost of $100 saving 1,102 kWh				

FWB Number:	10951	Eco #:	5	Building:	Gillen Activities Bldg
Investigation Finding:	AHU on when not scheduled		Equipment or System(s):	AHU with heating and cooling	
Measure:	Correct the scheduling issues with this unit.				

FWB Number:	10951	Eco #:	9	Building:	Gillen Activities Bldg
Investigation Finding:	Lower minimum set point on VAV boxes		Equipment or System(s):	AHU with heating and cooling	
Measure:	Adjust VAV minimums for AHU-1 through AHU-7 from 50% to 25%.				

FWB Number:	10951	Eco #:	10	Building:	Gillen Activities Bldg
Investigation Finding:	AHU 1, 4 and 6 supply excess venitilation air.		Equipment or System(s):	AHU with heating and cooling	
Measure:	Re-balance AHU-1, 4, and 6 to new OA minimums (half the existing) and let the units increase OA when CO2 approaces 1100 ppm to the current 10% minimum.				

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Public Buildings Enhanced Energy Efficiency Program

ATTACHMENT 4: SCREENING RESULTS FOR MINNESOTA ACADEMIES BLIND CAMPUS

MSAB

April 22, 2011

Summary Table

Facility Name	**MN Academies Blind Campus**
Location	400 SE 6th Ave, Faribault, MN 55021
Facility Manager	Randy Dirks Physical Plant Director Randy.dirks@msa.state.mn.us 507-384-6770
Number of Buildings	5
Interior Square Footage	122,666
PBEEEP Provider	CEE (Neal Ray)
State's Project Manager	Peter Hargreaves Peter,Hargreaves@state.mn.us 651-201-2395
Date Visited	January 13, 2010 and February 1, 2010
Annual Energy Cost	$160,106
Utility Company	Xcel Energy (Gas and Electric) MCF Faribault (steam)
Site Energy Use Index (EUI)	92 kBtu/ft2
Benchmark EUI (form B3)	105 kBtu/ft2

Recommendation for Investigation

This facility has buildings on it which were built between 1926 and 1971. The majority of the facility is compromised of two buildings which include the dormitory rooms for the residents on campus. These buildings compromise roughly 70% of the facility. The building controls for these two buildings were recently upgraded to DDC from pneumatics. This project was designed by an engineer and commissioned. The Library is also heavily used and had an HVAC upgrade performed in 2003. These three buildings, totaling 110,282 square feet are recommended for investigation.

Building Name	**State ID**	**Area (Square Feet)**	**Year Built**
Gillen Hall	E4400200666	21,127	1957
Lysen and Dorms	E4400201866	67,954	1971
Library for the Blind	E4400201666	21,201	1959
Not Recommended for Investigation			
Industrial Bldg	E4400200266	6,933	1942
Maintenance Bldg	E4400202266	5,451	1926

Minnesota Academies Blind Campus Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy saving opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. The screening of the Minnesota Academies Blind Campus was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. This report is the result of that information.

The Minnesota Academies Blind Campus is made up of 2 large interconnected buildings totaling 89,082 interior square feet, one detached library with 21,201 interior square feet, and two other smaller detached buildings totaling 12,384 interior square feet. The two main buildings run on a single automation system. The library is controlled by stand alone pneumatics and is not part of the automation system. The buildings were constructed between 1926 and 1971. There have been several mechanical upgrades during the history of the facility. The building has not changed its design intent; it has always been used primarily for classroom and dormitories.

General HVAC Overview
Overall, there are eleven air handlers, one roof top unit, three chillers, four chilled water pumps, and eight hot water pumps. Areas of the building which do not receive heat directly from the AHUs are primarily heated by finned tube radiation. The steam is brought to the facility by the power plant at MCF Faribault and is metered accordingly. The two storage buildings only contain finned tube radiation.

Controls and Trending
The two main buildings run on a single automation system (Alerton) which was installed in March of 2010. This system is capable of trending and every point can is set up for trending right now, however the amount of history that can be accumulated is not known. Currently it appears that one month of data is stored before it is overwritten. The library is controlled by stand alone pneumatics and is not part of the automation system. The remaining two buildings only contain finned tube radiation and unit heaters which are not on the new automation system and are either controlled by valves, or thermostats.

Lighting
Most of the interior lighting consists of T8 32 watt lights. These lights are mainly controlled by switches. There are occupancy sensors in some areas, such as the basement of the library.

EUI B3 Benchmark Overview
All energy bills and building information need to be entered into B3 before a EUI and B3 Benchmark score can be computed. A EUI of 92 kBtu/sqft was calculated from utility bills from 2010. The benchmark is 105. The EUI is about 12% below the benchmark; the average state building is 23% below the benchmark.

Metering
There is a total of one electric meter, one gas meter, and one steam meter for the campus. The steam meter is located within the boiler building of MCF Faribault.

Documentation
There is documentation of plans and operation and maintenance manuals for all buildings at this campus, including balancing reports; however it is not organized very well and tracking down information may take some time.

Mechanical Equipment Summary Table (Buildings Recommended for Investigation)	
1	Building Automation System
110,282	Square Feet
11	Air Handlers
1	Roof Top Unit
1	Fan Coil Units
76	VAV Boxes (estimated)
3	Chillers
14	Pumps (HW and CHW)
8	Exhaust Fans
1,600	Points Available for Trending
500	Minimum Points for Investigation
50	Data Loggers Required

PBEEEP Screening Report of Minnesota Academies Blind Campus PBEEEP # P10900

This screening report is based on the PBEEEP Guidelines. It is based on two site visits, review of the facility documentation, building automation system, a limited inspection of the facility and interviews with the staff. The purpose of the screening report is to evaluate the potential of the facility for the implementation of cost-effective energy efficiency savings through recommissioning. To the best of our knowledge the information here is accurate. It provides a high level view of many, but by no means all, of the important parameters of the mechanical equipment in the facility. Because it is the result of a limited audit survey of the facility, it may not be completely accurate.

Good Candidates for Investigation

Three buildings totaling 110,282 sqft listed below are good candidates for investigation. Each of these buildings have a moderate floor area and several air handling units. Two of them are controlled by a building automation system. The library is not, but has new mechanical equipment (2003); however it is not on the automation system and was not commissioned.

Lysen and Gillen					
Area (sqft)	89,081	Year Built	1957,1971		
HVAC Equipment					

Air Handlers (7 Total)

Description	Type	Size	Notes
AHU-1	Variable volume with VFD	5,000 CFM 5 HP SF	Contains 8 VAV boxes with no reheats. Spaces are heated by radiation.
AHU-2	Variable volume with VFD	5,000 CFM 5 HP SF	Contains 8 VAV boxes with no reheats. Spaces are heated by radiation.
AHU-3	Variable volume with VFD	5,000 CFM 5 HP SF	Contains 8 VAV boxes with no reheats. Spaces are heated by radiation.
AHU-4	Variable volume with VFD on SF and RF	14,000 CFM 20 HP SF 10 HP RF	Contains 24 VAV boxes with reheat coils
AHU-5	Variable volume with VFD on SF and RF	7,000 CFM 10 HP SF 7.5 HP RF	Contains 3 VAV boxes with reheat coils
AHU-6	Variable air volume with VFD	10,000 CFM 15 HP SF	Contains 15 VAV boxes with reheats.
AHU-7	Variable air volume with vFD	8,500 CFM 10 HP SF	Contains 12 VAV boxes with reheats
RTU-1 (AHU-8)	Constant volume	10,740 CFM 15 HP SF 7.5 HP RF	Contains 9 duct hot water coils, AHU-8 on the Automation system
Gym Unit (AHU-9)	Variable volume with VFD		Unknown design information AHU-9 on Automation system
Pool Unit (AHU-10)			Unknown design information AHU-8 on the Automation system

Chilled Water System RM100

Description	Type	Size	Notes
Chiller-1	Air cooled	154 tons	
2 Chilled water pumps		15 HP	Need to verify if pumps have VFDs

HVAC Equipment Cont'd (Lysen and Gillen)

Hot Water System RM100

Description	Type	Size	Notes
2 HX	Steam to hot water	381 lbs/hr 1004 lbs/hr	For radiation and booster coils
2 HWPs		3 HP 25 gpm	For radiation
2 HWPs		5 HP 65 gpm	For booster coils
10 Booster coils	Hot water	420 to 9,000 CFM	
1 Domestic HX	Steam to hot water	Unknown	For domestic HW
1 Domestic HWP	Constant volume	1/15 HP	

Chilled Water System RM 50

Description	Type	Size	Notes
Chiller-1	Air cooled	145 tons	
2 Chilled water pumps	Constant volume	20 HP	Constant volume pump.

Hot Water System RM 50

Description	Type	Size	Notes
2 HX	Steam to hot water	381 lbs/hr 1004 lbs/hr	For radiation and booster coils
2 HWPs	3 HP	3 HP 25 gpm	For radiation
2 HWPs	3 HP	5 HP 65 gpm	For reheats

Fan Coil Units (1 Total)

Description	Type	Size	Notes
Computer Room	Air cooled	600 CFM 18,000 Btu/hr	

Cabinet Unit Heaters (Estimated 10 Total)

Description	Type	Size	Notes
CUHs	Hot water	48 Btu/hr	

Exhaust Fans (8 Total)

Description	Type	Size	Notes
8 EFs	Constant volume	340 to 8,800 CFM	

VAV (76 Total)

Description	Type	Size	Notes
VAV	Reheat and No Reheats	140-1060 CFM	

Points on BAS

Air Handlers

Description	Points
AHU-1 AHU-2 AHU-3	OA Damper, MAT, MAT setpoint, Heat valve %, CHW valve %, Humidifier command, SF status, SF speed, Duct static pressure, Duct static pressure setpoint, DAT, DAT setpoint, DARH, Space enthalpy, Space humidity, Space temperature, Building pressure, EF low speed command, EF high speed command, EF damper command, RA CO_2, RAT, Filer Differential Pressure
AHU-4 AHU-5 AHU-9	OA Damper, MAT, MAT setpoint, Heat valve %, Face bypass damper %, CHW valve %, Humidifier command, SF status, SF speed, Duct static pressure, Duct static pressure setpoint, DAT, DAT setpoint, DARH, Space enthalpy, Space humidity, Space temperature, Building pressure, RF status, RF speed, RA CO_2, RAT, Filer Differential Pressure
AHU-6 AHU-7 AHU-8	OA Damper, MAT, MAT setpoint, Heat valve %, CHW valve %, Humidifier command, SF status, SF speed, Duct static pressure, Duct static pressure setpoint, DAT, DAT setpoint, DARH, Space enthalpy, Space humidity, Space temperature, Building pressure, RF status, RF speed, RA CO_2, RAT, Filer Differential Pressure
AHU-10	OA Damper, MAT, MAT setpoint, Heat valve %, CHW valve %, Face bypass damper, SF status, SF speed, Duct static pressure, Duct static pressure setpoint, DAT, DAT setpoint, DARH, Space enthalpy, Space humidity, Space temperature, Building pressure, RF status, RF speed RA CO_2, RAT, Filer Differential Pressure

Chilled Water System

Description	Points
Mechanical RM 50	Chiller run status, Chiller alarm status, OA enable setpoint, CHWST setpoint, Building CHWST, Building CHWRT, CHWP-1 status, CHWP-1 amps, CHWP-2 status, CHWP-2 amps
Mechanical RM 100	Chiller run status, Chiller #1 alarm status, Chiller #2 alarm status , OA enable setpoint, Building CHWST, Building CHWRT, CHWP-1 status, CHWP-1 amps, CHWP-2 status, CHWP-2 amps

Hot Water System

Description	Points
Mechanical RM 50	Converter valve %, Current HWST setpoint, HWST, HWRT. RP-1 status, RP-1 speed, RP-1 amps, RP-2 status, RP-2 speed, RP-2 amps, RHP-1 status, RHP-1 speed, RHP-1 amps, RHP-2 status, RHP-2 speed, RHP-2 amps
Mechanical RM 50 Domestic HW	Converter valve %, Current HWST setpoint, HWST, Domestic pump status, Domestic pump amps, Domestic HWST setpoint, PRV-1 Outlet pressure
Mechanical RM 100	1/3 Converter valve %, 2/3 Converter valve %, PRV discharge pressure, Current HWST setpoint, HWST, HWRT. RP-1 status, RP-1 speed, RP-1 amps, RP-2 status, RP-2 speed, RP-2 amps, RHP-1 status, RHP-1 speed, RHP-1 amps, RHP-2 status, RHP-2 speed, RHP-2 amps
Mechanical RM 100 Domestic HW	Converter valve %, Current HWST setpoint, HWST, Domestic pump status, Domestic pump amps, Domestic HWST setpoint, PRV-1 Outlet pressure

Points on BAS cont

VAV

Description	Points
VAV	Cooling demand, Heating demand, Current airflow setpoint, Minimum airflow setpoint, Maximum airflow setpoint, Reheat airflow setpoint, Need more airflow Signal, Occupied setpoint, Heating/Cooling mode setpoint, Mode, Unoccupied setpoint, Space temperature, Damper %, Reheat valve %, Actual CFM, DAT, FTR valve %

Transfer Fan or Exhaust fan

Description	Points
Fan	Fan status, Fan amps

Pool Spa

Description	Points
Pool Spa	Pool HWST, Pool HWRT, Pool HWP amps, Spa HWST, Spa HWRT, Spa HWP amps

Exterior Lighting

Description	Points
Lights	Exterior light sensor, % Dark, % Light, Exterior perimeter light cmd, Sietz field lights cmd

Library for the Blind					
Area (sqft)	21,201	Year Built	1959	Mechanical Upgrade	2003

HVAC Equipment

Air Handlers (2 Total)

Description	**Type**	**Size**	**Notes**
AHU-1	Variable air volume	10,000 CFM 15 HP SF	Contains a VFD and 6 VAV installed in 2003
AHU – 2	Constant Volume	5 HP (?)	Original to building, VFD

Chilled Water System RM 50

Description	**Type**	**Size**	**Notes**
Chiller-1	Water cooled	28 tons	In basement
2 Chilled water pumps	5 HP		Constant volume pump.

Heat Exchanger

Description	**Type**	**Size**	**Notes**
HX	Steam to Hot Water		In basement
2 Hot water pumps	3 HP		Constant volume pump.

Power Roof Ventilator (1 Total)

Description	**Type**	**Size**	**Notes**
PRV-1		8,800 CFM	Associated with AHU-1

Points on BAS

- No BAS

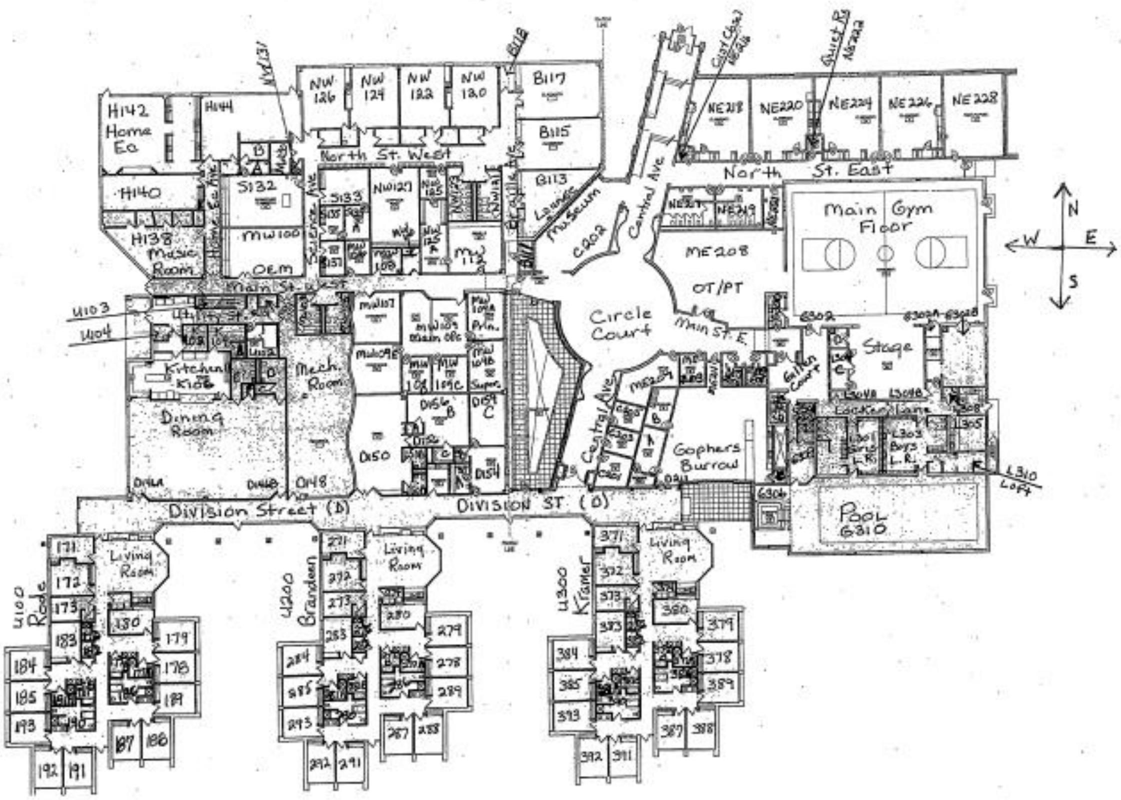
Poor Candidate for Investigation

These two buildings are not recommended for an investigation. They have a smaller floor area, limited mechanical equipment, and no equipment on an automation system.

Industrial Bldg			
Area (sqft)	6,933	Year Built	1942
HVAC Equipment			
- Heated with radiation along perimeter			
Points on BAS			
- No BAS			

Maint Bldg			
Area (sqft)	5,451	Year Built	1926
HVAC Equipment			
- Heated with radiation along perimeter and CUH gas fired heaters			
Points on BAS			
- No BAS			

Facility Map (Lysen, Gillen and Dorms)



(The Library Map is not included)

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HUH	Horizontal Unit Heater
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CUH	Cabinet Unit Heater	MAT	Mixed Air Temperature
CV	Constant Volume	MAU	Make-up Air Unit
DA	Discharge Air	OA	Outside Air
DA Enth	Discharge Air Enthalpy	OA Enth	Outside Air Enthalpy
DARH	Discharge Air Relative Humidity	OARH	Outside Air Relative Humidity
DAT	Discharge Air Temperature	OAT	Outside Air Temperature
DDC	Direct Digital Control	Occ	Occupied
DP	Differential Pressure	PTAC	Packaged Terminal Air Conditioner
DSP	Duct Static Pressure	RA	Return Air
DX	Direct Expansion	RA Enth	Return Air Enthalpy
EA	Exhaust Air	RARH	Return Air Relative Humidity
EAT	Exhaust Air Temperature	RAT	Return Air Temperature
Econ	Economizer	RF	Return Fan
EF	Exhaust Fan	RH	Relative Humidity
Enth	Enthalpy	RTU	Rooftop Unit
ERU	Energy Recovery Unit	SF	Supply Fan
FCU	Fan Coil Unit	Unocc	Unoccupied
FPVAV	Fan Powered VAV	UH	Unit Heater
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes
HP	Horsepower	VUH	Vertical Unit Heater

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH